DEVICE AND METHOD FOR WET TREATING LAUNDRY

BACKGROUND OF THE INVENTION

1. Technical Field.

The invention relates to a device for wet treatment of laundry, in particular a washer-extractor with an inner drum which is rotationally driven about a rotation axis and can preferably pivot about at least one pivot axis extending transversely with respect to the rotation axis and which receives the laundry that is to be treated, the inner drum having at least one front-end opening, with an inner drum which is rotationally driven about a rotation axis and can preferably pivot about at least one pivot axis extending transversely with respect to the rotation axis and which receives the laundry that is to be treated, and a preferably stationary drum housing surrounding the inner drum, and with an inner drum which is rotationally driven about a rotation axis and can preferably pivot about at least one pivot axis extending transversely with respect to the rotation axis and which receives the laundry that is to be treated, and a preferably stationary drum housing surrounding the inner drum,, and to a method in which an inner drum that can be driven in rotation about a rotation axis is loaded with the laundry or other items that are to be treated, and the laundry or other items are then washed and preferably spin-dried.

2. Prior Art.

Devices of the kind in question here are used to subject laundry or other items, for example carpets, dirt-collecting mats or the like, to a wet treatment. Where reference is made only to laundry in the text that follows, this is not intended to exclude the use of the device for washing other items. The devices are mainly used to wash the laundry or other items and then to spin-dry them. In specialist terminology, these devices are referred to as washer-extractors.

Known devices of this kind have openings for loading the laundry and openings for unloading the laundry or other items, because the loading, washing, optional spin-drying, and unloading take place at least in some cases at different pivot positions of the drum. These openings have to be closed during the treatment, namely washing and/or spin-drying, specifically by doors.

In practice, the known devices have proven problematic during loading. Particularly when stiff articles of laundry or items such as carpets and dirt-collecting mats are to be treated, only a limited quantity can be accommodated in the drum, because stiff laundry or items quite quickly fill the inner space of the drum and then do not permit any further loading.

If the device is used for wet treatment of laundry or other items that have to meet certain hygiene requirements, preferably that of being sterile, the device is used between a dirty area and a clean area. These areas are preferably separated from one another by a dividing wall. In specialist terminology, this is then referred to as a device in the dividing wall area. This requires that the washed and, if appropriate, spin-dried laundry be unloaded from the device separate from the dirty area, so that the treated laundry necessarily arrives in the clean area without being able to come into contact with the dirty area. Such devices have hitherto had to have a separate loading opening and unloading opening. The loading opening is located in the dirty area, while the unloading opening opens out in the clean area. Each of the separate openings has its own door, in which case one opening, preferably the loading opening, has to be assigned to the jacket of the drum, which requires a particularly complex door in order to ensure reliable closure of this opening.

BRIEF SUMMARY OF THE INVENTION

The object of the invention is to make available a method and a simple device for wet treatment of laundry, in particular a washer-extractor, with which at least the loading and unloading can take place at different pivot positions of the drum and/or the drum can be loaded with the greatest possible quantity of laundry or other items.

This object is achieved by a device, in particular a washer-extractor, with an inner drum which is rotationally driven about a rotation axis and can preferably pivot about at least one pivot axis extending transversely with respect to the rotation axis and which receives the laundry that is to be treated, the inner drum having at least one front-end opening, characterized in that the inner drum has a single front-end opening, and a door is assigned where appropriate to this opening. Accordingly, the drum or each drum has only a single opening, which can be closed where appropriate by a separate door. Compared to conventional devices, in particular those where the drum has two openings, each of which has to be closed by its own door, this device is of a much simpler design and is therefore less expensive to produce, because it requires only the single opening in each drum (outer drum and inner drum) and, where necessary, only a single door for closing the opening.

The door is preferably designed as a separate door. It does not have to be pivoted together with the drum, for example when the drum is transferred from the unloading position to the loading position. The door is therefore stationary and allows the same door to be used for loading and unloading, for which purpose the drum can be pivoted to and fro between a loading position and an unloading position, that is to say the loading position and unloading position of the drum do not have to be the same, which is necessary in order to use the device in dividing wall operation, when loading takes

place in the dirty area and unloading takes place in the clean area.

In a preferred embodiment of the invention, the door is separated from the drum in such a way that the door does not co-rotate with the drum and also cannot pivot with the drum, at least not into the loading position. The door therefore does not limit the angle of pivoting of the drum. The drum can thus be pivoted to different positions, and so the opening can also assume different positions. In this way, the single opening in each drum can migrate from the unloading position to the loading position, and the door does not get in the way, since according to the invention it does not move together with the drum, for example from the unloading position to the loading position. For this reason, each drum does not need to have a plurality of openings for the unloading and loading positions. Also, in the case of a device arranged in the dividing wall area, the single opening can also be pivoted into the dirty area for loading the drum, whereas, in order to unload the drum, it can be brought into a position in which the washed and if appropriate spin-dried laundry necessarily arrives in the clean area.

The door can preferably be moved toward the opening of the drum and also away from the opening, and if appropriate can be tilted slightly. Otherwise, however, the door is stationary relative to the drum. The to and fro movement of the door serves to seal the opening for the wet treatment. When the door is moved away from the opening, it frees the opening so that the drum can be pivoted. When the drum is pivoted, this is done without the door, so that the drum can be pivoted without being impeded by the door, and specifically into any desired pivot positions. In doing so, the opening is at all times free, so that, by simple pivoting, the drum can be brought into any desired loading positions and loaded, specifically through the (single) opening, which is also used for unloading.

Alternatively, provision can also be made for the drum or each drum with the opening to be driven to the door (and back). The door can then be designed to be entirely or at least for the most part stationary, because it no longer has to be moved to and fro relative to the single opening of the drum or of each drum.

The device preferably has a rotatably driven inner drum and a water-impermeable drum housing surrounding the latter. The drum housing is stationary relative to the inner drum, that is to say cannot be driven in rotation along with the inner drum. During the wet treatment, the inner drum therefore rotates inside the stationary drum housing. The drum housing also has just a single opening, which corresponds with the opening of the inner drum. The opening of the drum housing is preferably arranged adjacent to the opening of the inner drum. The door is then assigned to the opening of the drum housing, and the opening of the inner drum lying adjacent to the opening of the drum housing can be closed directly by the door assigned to the opening of the drum housing. Where the above text has mentioned a door for closing the opening of the drum, this means, in the case of an inner drum surrounded by a drum housing, the same door that then closes the opening of the drum housing.

According to a preferred embodiment of the device, the door has at least one peripheral seal which corresponds with a sealing face surrounding the opening of the drum housing. In this way, with the inner drum rotating during the wet treatment, an effective seal is obtained between the stationary door and the likewise stationary drum housing. However, the seal allows the door to be moved away from the drum housing when the drum housing is pivoted with the inner drum into the loading position and if appropriate also the unloading position, since the rotation axis of the inner drum, extending horizontally during the wet treatment, acquires another, for example vertical course.

According to a possible embodiment of the device, the door is mounted on a door frame. The door and the door frame can be moved axially to and fro in order to close the opening of the housing, the seal preferably being assigned in this case to the door frame. The door is preferably articulated pivotably on the door frame, so that the door is movable, preferably pivotable relative to the door frame for opening and closing it. In this way, the drum can be loaded with the inner part of the door opened.

Provision is also made for the entire door, or only the door frame, to be mounted on a preferably fixed door support. For this purpose, a flexible connecting means is provided between the door and the fixed door support. The door support holds the entire door, or the door frame and the inner part of the door, particularly when the door is moved away from the opening of the drum housing. The door support thus holds the entire door essentially fixed in position when the drum housing is pivoted with the inner drum, for example to transfer the device to the loading position.

In a device of the kind used in a dividing wall, the door is arranged in a dividing wall between the dirty area with unwashed laundry and the clean area with washed laundry. The door thus forms part of the dividing wall, so that the dividing wall serves at the same time as a door support.

A further independent solution to the aforementioned object, and one that may represent a preferred development of the above-described device, comprises in particular a washer-extractor, with an inner drum which is rotationally driven about a rotation axis and can preferably pivot about at least one pivot axis extending transversely with respect to the rotation axis and which receives the laundry that is to be treated, and a preferably stationary drum housing surrounding the inner drum, characterized in that the inner drum and the drum housing surrounding it can pivot about the

at least one pivot axis into any desired loading positions. Accordingly, the inner drum, together with the drum housing surrounding it, can be pivoted preferably continuously about the pivot axis into any desired loading positions. The drum housing can preferably also be pivoted with the inner drum into any desired unloading positions. The device can thus be employed in a versatile manner, specifically either as a normal configuration outside a clean area (without dividing wall) or as a dividing wall configuration. Whereas, in the dividing wall configuration, the unloading takes place at a position that deviates only slightly from the operating position and the pivoting is needed only for loading the drum, in the standard configuration the drum also has to be pivoted, for unloading purposes, into a position that deviates greatly from the position in which the wet treatment takes place. Since the inner drum can be pivoted along with the drum housing into the loading position and if appropriate also into the unloading position, the device can be adapted to any desired spatial conditions. Thus, the loading and/or unloading can take place when the inner drum is at positions within the drum housing which permit the easiest possible loading and unloading under the given conditions.

The pivot axis is preferably formed by two opposite axle journals which, lying on a common (imaginary) axis, are secured at opposite ends on the outside of the drum housing. At least one of these axle journals is assigned a direct pivot drive. In this way, the preferred pivoting of the drum housing with the inner drum can be achieved in a manner that saves space.

According to a preferred development of the device, at least one of the axle journals for forming the pivot axis can be assigned a delivery means for supplying the media needed for wet treatment of the laundry. In this way, a simple supply of media is possible despite the pivotability of the drum housing with the inner drum. A rotary attachment of at

least one admission line for the media is preferably formed in a front end of the at least one axle journal. Despite the fact that the axle journal rotates in order to pivot the inner drum, the rotary attachment ensures leaktight admission of media, specifically at any time and at any pivot position of the drum housing with the inner drum located therein.

A further device for achieving the aforementioned object, and one which may also represent a preferred development of the above-described devices, comprises, in particular a washer-extractor, with an inner drum which is rotationally driven about a rotation axis and can preferably pivot about at least one pivot axis extending transversely with respect to the rotation axis and which receives the laundry that is to be treated, and a preferably stationary drum housing surrounding the inner drum, characterized in that the at least one medium necessary for the wet treatment can be delivered to the inside of the drum housing, in particular of the inner drum, through a door assigned to the opening of the drum housing. Accordingly, the media necessary for the wet treatment are delivered into the drum housing, or into the inner drum rotating therein, through a door assigned to the single opening of the drum housing or of the inner drum. The door is especially suitable for the delivery of media when, as in the devices described above, it does not revolve along with the rotatably driven inner drum and cannot pivot with the drum housing. Because the door is largely stationary, it can be provided with at least one fixed admission line for at least one medium, preferably for all the media. A rotary attachment is therefore not needed. The leaks that may possibly arise when a rotary attachment is used are therefore reliably avoided.

When the door is made up of a door frame and of an inner door part that is to be opened, the at least one attachment for all media or for only individual media can expediently be assigned to the stationary door frame, preferably to a

part thereof which is enclosed by the peripheral seal between the door frame and the opening of the drum housing. Rigid attachments for connecting the at least one admission line for one or more media can then be assigned to the fixed door frame, but also to the pivotable inner part of the door.

A method for achieving the aforementioned object comprises an inner drum that can be driven in rotation about a rotation axis and is loaded with the laundry or other items that are to be treated, and the laundry or other items are then washed and preferably spin-dried, characterized in that loading is carried out with the rotation axis of the inner drum perpendicular or inclined relative to the perpendicular, and, during loading, the inner drum is driven in rotation at least intermittently about the rotation axis. Accordingly, the loading is carried out with the rotation axis of the inner drum perpendicular or inclined relative to the perpendicular, and the inner drum is driven in rotation during loading, specifically throughout the entire loading operation or during only part of the loading operation. This method allows the inner drum to be loaded with a relatively large quantity of laundry. In particular, the method according to the invention allows the inner drum to be loaded with a much larger quantity of stiff items, for example carpets or mats, compared to loading when the inner drum is stationary.

According to a preferred development of the method, the inner drum is loaded while rotating at a speed of rotation which is such that the laundry in the inner drum is exposed to a centrifugal acceleration corresponding to up to 25 times, in particular up to 20 times gravitational acceleration. It has been found that even bulky articles of laundry or other items then settle on the inner surface of the rotated inner drum and, in doing so, an inner, central area of the inner drum is kept constantly free for other articles of laundry or other items. In this way, the inner

drum can be loaded with a relatively large quantity of even bulky articles of laundry or other items.

Provision is also made that, when the inner drum is loaded with the rotation axis inclined relative to the perpendicular, the rotation axis can only be inclined maximally relative to the perpendicular to such an extent that the articles of laundry or other items for the most part still reach a bottom area of the inner drum lying opposite a loading opening. In this way, the central, inner area of the inner drum is very reliably kept free for loading it with subsequent articles of laundry or other items. This is generally achieved if, during loading, the rotation axis of the inner drum is inclined relative to the perpendicular by a maximum of 60°, preferably by not more than 45°.

BRIEF DESCRIPTION OF THE DRAWING

Two preferred illustrative embodiments of the device according to the invention, and the method according to the invention, are explained in greater detail below with reference to the drawing, in which:

Fig. 1 shows a schematic view of the device according to a first illustrative embodiment of the invention in a loading position,

Fig. 2 shows the device from Fig. 1 in an alternative loading position,

Fig. 3 shows the device from Figs. 1 and 2 in a wet treatment position, but with the door not yet located in the wet treatment position,

Fig. 4 shows the device from Fig. 3 with the door also located in the wet treatment position,

Fig. 5 shows the device from Figs. 1 to 4 in the unloading position,

Fig. 6 shows a device according to a second illustrative embodiment of the invention in a loading position,

Fig. 7 shows the device from Fig. 6 in a wet treatment position, with the door not yet located in this position,

Fig. 8 shows the device from Fig. 7 with the door also located in the wet treatment position, and

Fig. 9 shows the device from Figs. 6 to 8 in an unloading position.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The device according to the first illustrative embodiment of the invention, shown in Figs. 1 to 5, is a device designed as a washer-extractor 10 for standard commercial application. The washer-extractor 10 comprises an inner drum 12 which can be driven in rotation about a pivotable rotation axis 11. At one end face, the inner drum 12 has only a single opening 13 substantially across the whole surface. Moreover, the washer-extractor 10 comprises a water-tight drum housing 14 which surrounds the water-permeable inner drum 12 and which is stationary relative to the inner drum 12. Thus, in contrast to the inner drum 12, the drum housing 14 cannot be driven in rotation. On one end face, the drum housing 14 also has a single opening 15 across almost the whole surface. The opening 15 of the drum housing 14 is located in that end face of the drum housing 14 to which the opening of the inner drum 12 also points, such that the openings 13 and 15 are adjacent to one another and thus correspond with one another.

At a closed rear face 16, the inner drum 12 is mounted on a drive shaft (not shown in the figures) of a drive mechanism, preferably of an electric motor 17. If appropriate, a gear can be assigned to the electric motor 17. The inner drum 12 is then mounted with the closed rear face 16 on the drive shaft of the gear. The electric motor 17 (and if appropriate the gear) are secured nonrotatably on a closed rear wall 18 of the drum housing 14. In this way, the rear wall 18 of the drum housing 14 supports the inner drum 12 and the drive.

The drum housing 14 is mounted elastically, preferably via pneumatic springs 19, on a frame base 20. The frame base 20 is formed by a stationary, lower base part 21 and by a pivot frame 23 which can pivot relative to the latter about a horizontal pivot axis 22 extending transversely with respect to the rotation axis 11 of the inner drum 12. The pneumatic springs 19 that support the drum housing 14 of the inner drum 12 are located on the pivot frame 23. It is also conceivable, however, for the frame base 20 to be formed in one piece, so that it does not have a pivot frame 23 with the pivot axis 22. In this case, the drum housing 14 with the inner drum 12 can be pivoted directly and not from the frame base 20.

In the device shown here, the drum housing 14 and the inner drum 12 arranged therein do not rest directly on the pneumatic springs 19. Instead, two parallel supports 24 are arranged on the pneumatic springs 19 arranged on the frame base 20, and these two parallel supports 24 support the drum housing 14. The two supports 24 are assigned to opposite sides of the drum housing 14, and specifically at such a spacing that part of the drum housing 14 is located between the supports 24 and can protrude downward between the supports 24. Accordingly, each of the two supports 24 is mounted on two of the total of four pneumatic springs 19. On each support 24 there is a bearing 25 for receiving an axle journal 26 with rotation at opposite ends of the drum

housing 14. The opposite axle journals 26, which protrude outward relative to the drum housing 14, lie on a common, imaginary horizontal pivot axis 27 that intersects the rotation axis 11 of the inner drum 12 at right angles. At least one axle journal 26 is assigned a direct drive 28 which, in the illustrative embodiment shown, is made up of an electric motor with a step-down gear. However, it is also conceivable to provide a slewing gear motor for stepless pivoting of the drum housing 14 with the inner drum 12. By means of the direct drive 28, the drum housing 14 with the inner drum 12 can be pivoted steplessly about the pivot axis 27 and into different positions, specifically into any desired loading positions (Figs. 1 and 2), a wet treatment position for washing and spin-drying (Fig. 4) and any desired unloading positions (Fig. 5).

Fig. 1 showed a loading position of the washer-extractor 10 in which the drum housing 14 with the inner drum 12 is pivoted by the direct drive 28 such that the rotation axis 11 of the inner drum 12 extends perpendicularly. Fig. 2 shows an alternative loading position in which the rotation axis 11 extends at an inclination, specifically at 60° to the vertical in the illustrative embodiment shown. Any other desired loading positions alongside this one are also conceivable, but they should not exceed an inclination of 60° to the vertical. The most effective loading is obtained when the inclination relative to the vertical is only 50°, preferably only 40°. Fig. 4 shows the operating position of the washer-extractor 10 in which the washing and spin-drying of the laundry take place. Here, the rotation axis 11 of the inner drum 12 and the coincident longitudinal center axis of the drum housing 14 are oriented horizontally. To unload the washed and spin-dried laundry, the drum housing 14, with the inner drum 12 of the washer-extractor 10 mounted rotatably therein, is pivoted from the operating position (Fig. 4) until the rotation axis 11 of the inner drum 12 extends in the direction of the opening 13, 15 at a slightly downward inclination relative to the horizontal

(Fig. 5). Depending on requirements, this inclination for unloading the washer-extractor 10 can preferably be altered continuously and in any desired way during the unloading, on account of the direct drive 28. A suitable program can be provided for controlling the position of the drum housing 14 with the inner drum 12 arranged therein during loading and/or unloading. In addition, the washer-extractor can be loaded and/or unloaded with the inner drum 12 being rotated at least intermittently.

The washer-extractor 10 comprises only a single door 29. The one door 29 is used to close the single opening 15 in an end face of the drum housing 14 remote from the rear wall 18 and also at the same time to close the single opening 13 of the inner drum 12. According to the invention, the door 29 is designed as a separate door 29, which is not connected to the drum housing 14 and to the inner drum 12. When the door 29 closes the opening 15 of the drum housing 14, this also leads, not directly but indirectly, to closure of the single opening 13 on the end face of the inner drum 12 remote from the end face 16.

The door 29 can be driven away from and toward the opening 15 along a rectilinear horizontal path which, when the washer-extractor 10 is in the operating position (Figs. 3 and 4), lies on the rotation axis 11 of the inner drum 12 and forms an axial continuation of this. Otherwise, the door 29 is connected to a door support 30 and stationary relative to the inner drum 12 and to the drum housing 14. Accordingly, the door 29 does not co-rotate with the rotatably driven inner drum 12 during operation of the washer-extractor 10. Moreover, the door 29 cannot pivot with the drum housing 14 and with the inner drum 12 arranged in the latter.

The door support 30 is connected rigidly and completely immovably to the supports 24 of the drum housing 14. Accordingly, in contrast to the door 29, the door support 30

cannot be moved toward and away from the openings 13 and 15. To ensure that the door 29 can be moved toward and away from the openings 13 and 15 along the rotation axis 11, a flexible connecting means 31 is located between the outer circumference of the door 29 and the door support 30 and, in the illustrative embodiment shown, this flexible connecting means is designed as a tubular bellows 31 extending about the circumference. The connecting means can, however, also be formed by a simple elastic tube, for example a rubber tube. By means of the elasticity of the bellows 31 connecting the door 29 sealingly to the door support 30, or of another connecting means, the door 29 can also be moved toward and away from the door support 30, that is to say the spacing between the door 29 and the parallel door support 30 can be altered (Figs. 3 and 4).

The door 29 is also connected to the door support 30 by way of guides 32. In the figures, two guides 32 are shown. It is conceivable to provide more than two guides 32, or also just a single guide. The guides 32 stabilize the door 29 on the path of movement continuing the rotation axis 11 during the movement toward the opening 15, 13 and during the movement away from the opening 13, 15, because the bellows 31 between the door 29 and the door support 30 is of an elastic design and cannot therefore provide any guiding of the door 29. The axial movement of the door 29 on the rotation axis 11 can at the same time take place via the guides 32 when these are designed as spindle drives. It is also conceivable, however, to use additional drives (not shown in the figures) in order to drive the door 29, for example pneumatic cylinders.

In the illustrative embodiment shown, the door 29 is made up of three segments, specifically an outer ring segment 33, a central profiled segment 34 and an inner circle segment 35. The circle segment 35 can be formed by a glass disk, as a result of which the door 29 has a viewing glass. In the illustrative embodiment shown, the guides 32 engage on the

inner circle segment 35 of the door 29. However, it is also conceivable to assign the guides 32 to other parts of the door 29, for example to the outer ring segment 33. The profiled segment 34 is specially curved inwards, specifically in such a way that the profiled segment 34 has an outer frustoconical end segment 36. When the door 29 is driven toward the opening 15 of the drum housing 14 in the operating position of the washer-extractor 10, the end segment 36 protrudes into the opening 13 of the inner drum 12, as a result of which the cylindrical edge of the opening 13 surrounds the end segment 36 with a slight clearance or play. In this way, the opening 13 of the inner drum 12 is also largely closed by the door 29, namely by the end segment 36 thereof (Fig. 4), but not completely sealed off.

The door 29 has a circumferential seal 37 which serves to seal the opening 15 of the drum housing 14 in the operating position of the washer-extractor 10, at least to such an extent that no fluid can escape from the drum housing 14 during operation of the washer-extractor 10. In the illustrative embodiment shown, the seal 37 is formed by two circular seal profiles 38, 39 which extend circumferentially and are concentric to one another. The seal profiles 38, 39 are assigned to the outer ring segment 33, and specifically, in the illustrative embodiment shown, roughly in the area of transition of the ring segment 33 to the profiled segment 34. Both sealing profiles 38 protrude in the direction of the drum housing 14 relative to the inner wall of the circle segment 33 pointing to the opening 15. The distance between mutually oriented sealing faces of the seal profiles 38 and 39 is configured such that a front part of a cylindrical sealing ring 40 surrounding the opening 15 of the drum housing 14 engages between the seal profiles 38 and 39 when the door 29 is driven toward the opening 15 in the operating position of the washer-extractor 10 (Fig. 4). The sealing ring 40 of the drum housing 14 corresponds with the sealing profiles 38 and 39 on the door 29 in such a way that an at least liquid-tight closure of the opening 15 of the drum

housing 14 is achieved by sealing between the seal profiles 38 and 39 of the door 29 and the sealing ring 40 of the drum housing 14.

The delivery of media to the washer-extractor 10 is done in a manner particular to the invention. These media mainly involve wash water and wash auxiliaries, in particular detergents, which have to be introduced into the washer-extractor 10 from the outside before and/or during the washing operation. The water arising from the spin-drying of the laundry also has to be removed. The delivery and/or removal of these media (not shown in the figures) can be effected in two different ways:

The door 29, in particular the inner circle segment 35 thereof, is provided with at least one attachment piece to which a passage in the door 29 is assigned. This at least one attachment piece is then used to deliver all the media, in particular water and detergent, to the flow washer 10. However, it is also conceivable to assign several attachment pieces for different media to the door 29, in particular in its circle segment 35. If the delivery of media to the interior of the drum housing 14 takes place through the door 29, the circle segment 35 (if the at least one attachment piece is assigned to it) is expediently not made of glass, but instead of a stainless material, from which the rest of the door 29 and other parts of the washer-extractor 10 are also made in principle. Since the door 29 can be moved linearly to and away from the drum housing 14 only along a relatively short path and is otherwise stationary, it is possible to use rigid or almost rigid attachments for lines for media delivery to the washer-extractor 10. It suffices if the delivery line for the media is formed completely, or only along a short section, from flexible tubes, in order to compensate for the only short travel of the door 29 along the rotation axis 11 of the inner drum 12.

It is alternatively possible to deliver media to the interior of the drum housing 14 via at least one axle journal 26. For this purpose, the axle journal 26 has a central axial through-bore. This through-bore is connected to a rotary attachment on the outer free end face of the axle journal 26. The at least one delivery line for media is in turn connected to the rotary attachment.

Figs. 6 to 9 show a second illustrative embodiment of the device, specifically a washer-extractor 41 in the so-called dividing wall arrangement or dividing wall configuration. This washer-extractor 41 is for use in clean areas, where particular hygiene requirements have to be observed. For this purpose, the washer-extractor 41 is loaded with soiled laundry in a dirty area 42. The washed and spin-dried laundry is unloaded in a clean area 44 isolated from the dirty area 42 by a dividing wall 43. The washer-extractor 41 is in principle constructed exactly like the washer-extractor 10. To this extent, reference is made to the preceding description of the washer-extractor 10, and identical reference signs are used for identical parts of the washer-extractor 41 in Figs. 6 to 9.

The drum housing 14 of the washer-extractor 41 containing the rotatable inner drum 12 is pivotable about the pivot axis 22 and about the pivot axis 27 extending parallel to the latter. To pivot the drum housing 14 about the pivot axis 22 between the lower base part 21 and the pivot frame 23 of the frame base 20, at least one bellows cylinder 45 is provided which can be expanded and contracted along a vertical axis. The bellows cylinder 45 is arranged between the stationary lower base part 21 and the pivot frame 23 at an end of the frame base 20 remote from the pivot axis 22.

Fig. 6 shows a possible loading position of the washer-extractor 41, with the rotation axis 11 of the inner drum 12 extending perpendicularly. The single openings 13 and 15 of the inner drum 12 and of the drum housing 14, respectively,

are then situated at the top and, in the dirty area 42, can thus be loaded from above with laundry that is to be washed. However, it is also conceivable to fill the washer-extractor 41 with soiled laundry in other positions in the dirty area 42, in which positions the rotation axis 11 extends at an angle to the vertical, for example with the drum housing 14 and inner drum 12 in a position as shown in Fig. 2 in connection with the washer-extractor 10. For loading, the drum housing 14 can be pivoted about the pivot axis 27 by the direct drive 28. Fig. 8 shows an operating position of the washer-extractor 41 in which the laundry is washed and then spin-dried. Here, the rotation axis 11 of the rotatably driven inner drum 12 is oriented horizontally. The drum housing 14 is also pivoted about the pivot axis 27 into the operating position. According to the view in Fig. 9, unloading of the washer-extractor 41 is carried out with the drum housing 14, and the inner drum 12 arranged therein, pivoted about the pivot axis 22. This pivoting is effected by expansion of the bellows cylinder 45, as a result of which the pivot frame 23 of the frame base 20 is lifted at the end directed away from the pivot axis 22. Here, the rotation axis 11 is slightly inclined relative to the horizontal, specifically downward in the direction toward the openings 13 and 15, so that, with the inner drum 12 preferably being driven in rotation, the washed laundry passes through the openings 13 and 15 into the clean area 44 on that side of the dividing wall 43 directed away from the dirty area 42.

The washer-extractor 41 also has a specially designed door 46 for closing the single opening 15 of the drum housing 14 and the single opening 13 of the inner drum 12. This door 46 is likewise arranged separately from the drum housing 14 of the inner drum 12, so that the door 46 can be separated from the drum housing 14 in order to pivot the drum housing 14 and inner drum 12 into the respective loading position about the pivot axis 27. The door 46 is stationary relative to the rotatably driven inner drum 12, as a result of which

the door 46 cannot co-rotate with the inner drum 12. In addition, the door 46 does not take part in the pivoting movement of the drum housing 14 and inner drum 12 about the pivot axis 27 when the drum housing 14 and inner drum 12 are pivoted into and out of the loading position. However, the door 46 can also be driven to and fro on a rectilinear path, which lies on the rotation axis 11, specifically driven toward the openings 13 and 15 and away from the openings 13 and 15. Unlike the door 29 of the washer-extractor 10, however, the door 46 is also able to pivot with the drum housing 14 and the inner drum 12 when the drum housing 14 and the inner drum 12 are pivoted about the pivot axis 22 on the frame base 20 and into the unloading position. However, this pivoting travel of the door 46 is limited to the relatively small pivot angle of the drum housing 14 of the inner drum 12 for unloading the washer-extractor 41. This angle is at most 30°, preferably only about 15° to 20° (Fig. 9).

The door 46 is made up of an inner door 47 and of a door frame 48 surrounding the latter. The door frame 48 is connected to a door support 50 via guides 49 which can be designed like the guides 32 in the washer-extractor 10. The door support 50 is in turn connected fixedly to the pivot frame 23 of the frame base 20. In the illustrative embodiment shown, the door support 50 is connected rigidly to the supports 24 of the pivot frame 23. The door support 50 at the same time forms part of the dividing wall 43. The door support 50 or this part of the dividing wall 43 is surrounded by an elastic membrane 51, which likewise forms part of the dividing wall 43. By means of the elastic membrane 51, the door support 50 forming an inner part of the dividing wall 43 can be pivoted relative to the vertical plane of the dividing wall 43 when the drum housing 14 with inner drum 12 is pivoted about the pivot axis 22 into the unloading position (Fig. 9). On the outside, the membrane 51 can be surrounded by another fixed part (not shown in the figures) of the dividing wall 43 lying in a vertical plane

of said dividing wall 43 in which the door support 50 and the membrane 51 also lie when the drum housing 14 with inner drum 12 is not located in the unloading position (Figs. 6 to 8).

The door 46 can be moved to and fro on a linear path which extends perpendicularly through the plane of the door 46 and which lies on the rotation axis 11 of the inner drum 12 (when this is in the operating position of the washer-extractor 41). In this way, the door 46 can be moved toward the openings 13 and 15 and away from them. At the same time, the parallel distance of the door 46 from the door support 50 and thus from the dividing wall 43 is altered by this means. In the operating position of the washer-extractor 41, the door 46 is located near the door support 50 and the dividing wall 43 (Fig. 8). By contrast, in the loading position of the washer-extractor 41, the door 46 is at a greater distance from the door support 50 (Fig. 6). When the door 46 is being moved toward the door support 50, and during movement away from the latter, the guides 49 are used to guide the door 46 on the horizontal path of movement continuing the rotation axis 11. At the same time, when they are designed as spindles, the guides 49 can be used for the axial driving of the door 46. Alternatively, it is also possible to drive the door 46 axially in the horizontal direction by means of other drives, for example at least one pneumatic cylinder.

The door 46, specifically the ring-shaped door frame 48, is connected to the door support 50 by a bellows 31 or a flexible tube. In this way, the door 46 can be moved with the inner door 47 and the door frame 48 toward and away from the door support 50.

The inner door 47 is made up of an outer ring segment 52, a profiled segment 53 surrounded by the latter, and an inner circle segment 54. The circle segment 54 and the profiled segment 53 are designed like the profiled segment 34 and the

circle segment 35 of the door 29 of the washer-extractor 10. By contrast, the ring segment 52 of the door 46 is smaller than the ring segment 33 of the door 29, because the ring segment 52 is still surrounded by the door frame 48. The ring segment 52 and the door frame 48 of the door 46 are together approximately as large as the ring segment 33 of the door 29.

A seal 55 for sealing the door 46 off relative to the opening 15 of the drum housing 14 is designed like the seal 37 of the door 29, namely composed of two concentric, annular seal profiles 56 and 57. An inner seal profile 56 is arranged near the outer edge of the ring segment 52 of the inner door 47, while an outer seal profile 57 is arranged near the inner edge of the door frame 48. The seal 55 is thus divided by the arrangement on the door frame 48 on the one hand and on the ring segment 52 on the other hand.

A particular feature of the door 46 is that the inner door 47 can be opened (Fig. 9) by being pivoted relative to the door frame 48 surrounding it, specifically about a horizontal rotation axle 58 which extends parallel to the pivot axes 22 and 27. The rotation axle 58 thus forms a kind of hinge with which the inner door 47 is connected pivotably to the outer door frame 48. In this way, the door 46 has a "door within a door", because the inner door 47 of the door 46 can be pivoted relative to the door frame 48 thereof. The pivoting of the inner door 47 relative to the door frame 48 is effected by a pivot drive 59 which, in the illustrative embodiment shown, is formed by an electric motor with a step-down gear. The slowly rotating drive shaft of the step-down gear is connected nonrotatably to the rotation axle 58. At the same time, the rotation axle 58 is secured nonrotatably on the inner door 47, so that the inner door 47 can be pivoted open and shut relative to the door frame 48 by the pivot drive 59. By arranging the rotation axle 58 with the pivot drive 59 on the upper edge of the

inner door 47, the inner door 47 can be pivoted upward, specifically toward the pivot drive 59 also located on the upper edge of the door 46 (Fig. 9). This means that, during unloading of the washer-extractor 41, neither the opened inner door 47 nor the pivot drive 59 gets in the way when the drum housing 14 is lifted by the bellows cylinder 45 at the rear end directed away from the door 46 and, by this means, the rotation axis 11 of the inner drum 12 is inclined relative to the openings 13 and 15 serving for unloading of the washed and spin-dried laundry (Fig. 9).

In the washer-extractor 41 too, the media can be delivered both through the door 46, preferably the inner door 47, and also through an axle journal 26 forming part of the pivot axis 27 of the drum housing 14 with inner drum 12. Since the inner door 47 of the washer-extractor 41 can be pivoted upward and the attachments for delivery of media would have to be assigned to this inner door 47, the delivery of media in the washer-extractor 41 advantageously takes place through at least one of the two axle journals 26. In terms of the concrete configuration of the means for delivery of media, not shown in Figs. 6 and 9, reference is made to the preceding description of the washer-extractor 10.

The method according to the invention is described in more detail below with reference to the washer-extractor 10 of the illustrative embodiment in Figs. 1 to 5.

The washer-extractor 10 is loaded either with the inner drum 12 pivoted completely upward, and the rotation axis 11 extending vertically (Fig. 1), or with the inner drum 12 at an inclination. In both cases, the openings 13 and 15 in the inner drum 12 and in the drum housing 14 are directed upward, so that the washer-extractor 10 can be loaded with laundry or other items from above or obliquely from the side. If loading takes place with the rotation axis 11 of the inner drum 12 not vertical, the inner drum 12 can be loaded with the rotation axis 11 inclined at a maximum of

60° to the vertical. However, the rotation axis 11 is preferably inclined less than this during loading, specifically only such that the rotation axis 11 of the inner drum 12 is inclined relative to the vertical by only up to 50°, in particular only 40°. The maximum inclination of the rotation axis 11 is expediently chosen such that, during loading, at least some of the articles of laundry or other items still reach a bottom area of the inner drum 12 remote from the opening 13 of the inner drum 12.

It is conceivable, during loading of the washer-extractor 10, preferably to continuously change the position of the drum housing 14, and of the inner drum 12 rotating therein, by gradually reducing the inclination of the rotation axis 11 relative to the vertical, and this can be done such that, by the end of the loading operation, the rotation axis 11 is perpendicular or almost perpendicular.

Another particular feature of the method according to the invention is that, during loading of the washer-extractor 10, the inner drum 12 is driven in rotation, preferably continuously, about the perpendicular or inclined, in particular slightly inclined, rotation axis 11. This is done at a speed of rotation below that at which the drum 12 is driven during the treatment of the laundry or other items. The speed of rotation at which the inner drum 12 of the washer-extractor 10 is driven during loading is preferably such that the articles of laundry or other items on the inside of the jacket of the inner drum 12 are exposed to a centrifugal acceleration that does not exceed 25 times gravitational acceleration, preferably in the range of 5 to 20 times gravitational acceleration. In this way, during loading of the washer-extractor 10, the articles of laundry or other items already located in the inner drum 12 are forced outward against the inner side of the jacket surface of the inner drum 12, so that an inner area of the inner drum 12 remains free, at least during most of the loading operation, for loading the inner drum 12 with further

articles of laundry or other items. In this way, the washer-extractor 10 operated by the method according to the invention can be loaded with a greater quantity of articles of laundry and other items than is possible in known washer-extractors where the loading is carried out while the inner drum 12 is stationary.

It is also possible to change the speed of rotation of the inner drum 12 during loading. The speed of rotation preferably increases as the inner drum 12 becomes increasingly loaded. The speed of rotation of the inner drum 12 during loading is in this case expediently program-controlled, in particular depending on the nature of the articles of laundry or other items that are to be loaded. The bulkier the articles of laundry or other items are, the higher should be the speed of rotation at which the inner drum 12 is driven during loading of the washer-extractor 10. The inner drum 12 can also be driven throughout the entire operation of loading the washer-extractor 10, or also only during part of the loading operation, in particular during a final phase of loading. The speed of rotation at which the inner drum 12 is driven during loading can also change during the loading, in particular decreasing toward the end of loading.

It is also conceivable, during the loading of the washer-extractor 10, to change the position, in particular the inclination, of the rotation axis 11 of the inner drum 12. This can be done in steps, but preferably takes place in a stepless manner. The inclination of the rotation axis of the inner drum 12 relative to the vertical is expediently reduced as loading proceeds, so that, at the end of the loading operation, the rotation axis 11 of the inner drum 12 can have reached a perpendicular or almost perpendicular position.

Just as the inner drum 12 of the washer-extractor 10 can be driven in rotation during loading, the inner drum 12 can

also be driven in rotation during the unloading of the washer-extractor 10. During unloading, however, the inner drum 12 is driven at only a relatively low speed of rotation, less than 5 times gravitational acceleration. It may also be expedient to change the inclination of the rotation axis 11 of the inner drum 12 during unloading too, preferably in opposite directions, so that there is an almost continuous ejection of the articles of laundry or other items from the inner drum. The change of inclination of the rotation axis 11 during unloading of the washer-extractor 10 can, if appropriate also like the speed of rotation of the inner drum 12, be program-controlled.

The method described above is suitable not only for a washer-extractor according to the illustrative embodiment in Figs. 1 to 5, but also for the washer-extractor according to the second illustrative embodiment of the invention (Figs. 6 to 9) and for any other desired washer-extractors. In particular, the method according to the invention, as described above, is also suitable for washer-extractors which are not used between a dirty area and a clean area and which are therefore not assigned a dividing wall. The method according to the invention is likewise suitable for washer-extractors with a single opening or also with several openings, the opening or each opening being able to be closed, so that the method according to the invention is not limited to the washer-extractors 10 and 41 shown in Figs. 1 to 9 but extends instead to all types of washer-extractors.

List of reference numbers

10	washer-extractor
11	rotation axis
12	inner drum
13	opening
14	drum housing
15	opening
16	front face
17	electric motor
18	back wall
19	pneumatic spring
20	frame base
21	lower base part
22	pivot axis
23	pivot frame
24	support
25	bearing
26	axle journal
27	pivot axis
28	direct drive
29	door
30	door support
31	bellows
32	guide
33	ring segment
34	profiled segment
35	circle segment
36	end segment
37	seal
38	seal profile
39	seal profile
40	sealing ring
41	washer-extractor
42	dirty area
43	dividing wall
44	clean area

45 bellows cylinder
46 door
47 inner door
48 door frame
49 guide
50 door support
51 membrane
52 ring segment
53 profiled segment
54 circle segment
55 seal
56 seal profile (internal)
57 seal profile (external)
58 rotation axis
59 pivot drive